**Module title**

Low-Dimensional Structures

**Abbreviation**

11-NDS-092-m01

**Module coordinator**

Managing Director of the Institute of Applied Physics

**Module offered by**

Faculty of Physics and Astronomy

**ECTS**

4

**Method of grading**

Only after succ. compl. of module(s)

**Numerical grade**

--

**Duration**

1 semester

**Module level**

graduate

**Other prerequisites**

Certain prerequisites must be met to qualify for admission to assessment. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course will be considered a declaration of will to seek admission to assessment. If students have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for assessment into effect. Students who meet all prerequisites will be admitted to assessment in the current or in the subsequent semester. For assessment at a later date, students will have to obtain the qualification for admission to assessment anew.

**Contents**

Low-dimensional structures: Crystal lattice symmetry. Lattice dynamics and growth techniques of low-dimensional structures. Comparison between these structures and volume solids. X-ray diffractometry. Molecular beam epitaxy.

**Intended learning outcomes**

The students have knowledge of the theoretical principles of the growth of low dimensional structures. They know methods of producing and analysing such structures. They know the bandstructures of the most important semiconductors as well as the fabrication and characteristics of semiconductor heterostructures and MOS-diodes. They are familiar with the subband structure of semiconductor heterostructures and MOS-diodes and can evaluate the importance of many-particle effects. They are able to solve problems related to potentials in one dimension by applying Poisson’s equation. They know the k*p perturbation theory and can deduce the 2D subband structure from the bulk band structure. They have knowledge of the meaning of modulation doping and are familiar with the 2D hydrogen atom. They understand how an external magnetic field acts on the properties of a free electron gas in 2D. They have basic knowledge of the meaning of gauging, Landau-quantisation, filling factor and Landau degeneracy. They understand the dependence of various physical properties on the filling factor, and are able to solve implicit problems via numerical methods. They are familiar with elementary excitations in two-dimensional systems.

**Courses**

<table>
<thead>
<tr>
<th>Type</th>
<th>Number of weekly contact hours</th>
<th>Language</th>
</tr>
</thead>
<tbody>
<tr>
<td>R + V</td>
<td>(no information on SWS)</td>
<td>(weekly contact hours)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>course language available)</td>
</tr>
</tbody>
</table>

**Method of assessment**

a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 8 to 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes)

Assessment offered: When and how often assessment will be offered depends on the method of assessment and will be announced in due form under observance of Section 32 Subsection 3 ASPO (general academic and examination regulations) 2009.

Language of assessment: German, English

**Allocation of places**

--

**Additional information**

--
### Module description

**Referred to in LPO I** *(examination regulations for teaching-degree programmes)*

---

**Module appears in**

<table>
<thead>
<tr>
<th>Bachelor’ degree (1 major) Physics (2010)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bachelor’ degree (1 major) Physics (2012)</td>
</tr>
<tr>
<td>Master's degree (1 major) Mathematics (2010)</td>
</tr>
<tr>
<td>Master's degree (1 major) Physics (2010)</td>
</tr>
<tr>
<td>Master's degree (1 major) Physics (2011)</td>
</tr>
<tr>
<td>Master's degree (1 major) Nanostructure Technology (2011)</td>
</tr>
<tr>
<td>Master's degree (1 major) Nanostructure Technology (2010)</td>
</tr>
<tr>
<td>Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010)</td>
</tr>
<tr>
<td>Master's degree (1 major) FOKUS Physics (2010)</td>
</tr>
<tr>
<td>Master's degree (1 major) FOKUS Physics (2011)</td>
</tr>
</tbody>
</table>

JMU Würzburg • generated 24.04.2020 • Module data record 114337